DAkkS
Deutsche
Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV
Signatory to the Multilateral Agreements of
EA, ILAC and IAF for Mutual Recognition

Accreditation

The Deutsche Akkreditierungsstelle GmbH attests that the

Rohde & Schwarz Meßgerätebau GmbH
Mühldorfstraße 15, 81671 München

with its calibration laboratory

Rohde-und-Schwarz-Straße 1, 87700 Memmingen

is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out calibrations in the following fields:

Electrical quantities

DC and frequency quantities
- DC voltage
- AC voltage
- DC current
- AC current
- DC resistance

Time and frequency
- Time interval
- Frequency

High frequency quantities
- HF voltage
- HF power
- HF impedance (reflectance factor)
- HF attenuation
- HF noise
- Waveform quantities
- Antenna quantities
- Rise time
- Modulation quantities

The accreditation certificate shall only apply in connection with the notice of accreditation of 30.11.2017 with the accreditation number D-K-15195-01 and is valid until 29.07.2019. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 11 pages.

Registration number of the certificate: **D-K -15195-01-01**

Braunschweig, 30.11.2017	Dr. Michael Wolf Head of Division	Translation issued: 30.11.2017	Head of Division

This document is a translation. The definitive version is the original German accreditation certificate.

See notes overleaf.

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The publication of extracts of the accreditation certificate is subject to the prior written approval by Deutsche Akkreditierungsstelle GmbH (DAkkS). Exempted is the unchanged form of separate disseminations of the cover sheet by the conformity assessment body mentioned overleaf.

No impression shall be made that the accreditation also extends to fields beyond the scope of accreditation attested by DAkkS.

The accreditation was granted pursuant to the Act on the Accreditation Body (AkkStelleG) of 31 July 2009 (Federal Law Gazette I p. 2625) and the Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products (Official Journal of the European Union L 218 of 9 July 2008, p. 30). DAkkS is a signatory to the Multilateral Agreements for Mutual Recognition of the European co-operation for Accreditation (EA), International Accreditation Forum (IAF) and International Laboratory Accreditation Cooperation (ILAC). The signatories to these agreements recognise each other's accreditations.

The up-to-date state of membership can be retrieved from the following websites:
EA: www.european-accreditation.org
ILAC: www.ilac.org
IAF: www.iaf.nu

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Annex to the Accreditation Certificate D-K-15195-01-01 according to DIN EN ISO/IEC 17025:2005

Period of validity: 30.11.2017 to 29.07.2019 Date of issue: 30.11.2017

Holder of certificate:

Rohde & Schwarz Meßgerätebau GmbH
Mühldorfstraße 15, 81671 München

with its calibration laboratory

Rohde-und-Schwarz-Straße 1, 87700 Memmingen

Head:	Dr. Gerhard Rösel	
Deputy head:	Otto Martetschläger	Günther Jocham
	Markus Vogt	Matthias Hübler
	Calin Dumitrescu	

Accredited as calibration laboratory since: 12.08.1996

Calibration in the fields:

Electrical quantities

DC and frequency quantities
- DC voltage
- AC voltage
- DC current
- AC current
- DC resistance

Time and frequency
- Time interval
- Frequency

High frequency quantities
- HF voltage
- HF power
- HF impedance (reflectance factor)
- HF attenuation
- HF noise
- Waveform quantities
- Antenna quantities
- Rise time
- Modulation quantities

Permanent Laboratory

Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability[1)]	Remarks
HF power Power meters with mismatch correction	1 mW	> DC to 1 MHz	$3{,}7 \cdot 10^{-3}$	Connector type[2)]: N50
		> 1 MHz to 50 MHz	$3{,}9 \cdot 10^{-3}$	
		> 50 MHz to 100 MHz	$4{,}1 \cdot 10^{-3}$	
		> 100 to 2 GHz	$6{,}6 \cdot 10^{-3}$	
		> 2 GHz to 8 GHz	$7{,}7 \cdot 10^{-3}$	
		> 8 GHz to 12,4 GHz	$8{,}8 \cdot 10^{-3}$	
		> 12,4 to 18 GHz	$12 \cdot 10^{-3}$	
		> 18 GHz to 26,5 GHz	$8{,}3 \cdot 10^{-3}$	Connector type[2)]: PC-2,92
		> 26,5 to 40 GHz	$9{,}6 \cdot 10^{-3}$	
		> 40 GHz to 50 GHz	$19 \cdot 10^{-3}$	Connector type[2)]: PC-2,4
		> 50 GHz to 67 GHz	$32 \cdot 10^{-3}$	Connector type[2)]: PC-1,85
		> 67 GHz to 75 GHz	$39 \cdot 10^{-3}$	Connector type[2)]: PC-1,10
		> 75 GHz to 95 GHz	$41 \cdot 10^{-3}$	
		> 95 GHz to 110 GHz	$43 \cdot 10^{-3}$	
	1 µW to 80 µW	> DC to 100 MHz	$6 \cdot 10^{-3}$	Connector type[2)]: N50
		> 100 to 2 GHz	$8 \cdot 10^{-3}$	
		> 2 GHz to 8 GHz	$12 \cdot 10^{-3}$	
		> 8 GHz to 12,4 GHz	$17 \cdot 10^{-3}$	
		> 12,4 to 18 GHz	$20 \cdot 10^{-3}$	
		> 18 GHz to 26,5 GHz	$22 \cdot 10^{-3}$	Connector type[2)]: PC-3,5
	80 µW to 10 mW	> DC to 100 MHz	$4 \cdot 10^{-3}$	Connector type[2)]: N50
		> 100 MHz to 2 GHz	$6{,}5 \cdot 10^{-3}$	
		> 2 GHz to 8 GHz	$9{,}2 \cdot 10^{-3}$	
		> 8 GHz to 12,4 GHz	$10 \cdot 10^{-3}$	
		> 12,4 GHz to 18 GHz	$13 \cdot 10^{-3}$	
		> 18 GHz to 26,5 GHz	$22 \cdot 10^{-3}$	Connector type[2)]: PC-3,5
	> 10 mW to 100 mW	> DC to 70 MHz	$7{,}1 \cdot 10^{-3}$	Connector type[2)]: N50
		> 70 MHz to 2 GHz	$8{,}3 \cdot 10^{-3}$	
		> 2 GHz to 8 GHz	$9{,}2 \cdot 10^{-3}$	
		> 8 GHz to 12,4 GHz	$10 \cdot 10^{-3}$	
		> 12,4 to 18 GHz	$13 \cdot 10^{-3}$	

[2)] The measurement uncertainty will increase with other connector systems

[1)] The best measurement capabilities are stated according to EA-4/02. These are expanded uncertainties of measurement with a coverage probability of 95% and have a coverage factor of k = 2 unless stated otherwise. Uncertainties without unit are relative uncertainties referring to the measurement value unless stated otherwise.

Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability[1)]	Remarks
Generator with mismatch correction	1 mW	> DC to 1 MHz	$2{,}3 \cdot 10^{-3}$	Connector type[2)]: N50
		> 1 MHz to 50 MHz	$2{,}7 \cdot 10^{-3}$	
		> 50 MHz to 100 MHz	$2{,}9 \cdot 10^{-3}$	
		> 100 to 2 GHz	$5{,}1 \cdot 10^{-3}$	
		> 2 GHz to 8 GHz	$6{,}4 \cdot 10^{-3}$	
		> 8 GHz to 12,4 GHz	$7{,}7 \cdot 10^{-3}$	
		> 12,4 to 18 GHz	$11 \cdot 10^{-3}$	
	1 mW	18 GHz to 26,5 GHz	$5{,}3 \cdot 10^{-3}$	Connector type[2)]: R220
		26,5 GHz to 40 GHz	$5{,}6 \cdot 10^{-3}$	Connector type[2)]: R320
		33 GHz to 50 GHz	$15 \cdot 10^{-3}$	Connector type[2)]: R400
		50 GHz to 67 GHz	$29 \cdot 10^{-3}$	Connector type[2)]: R620
		> 67 GHz to 75 GHz	$32 \cdot 10^{-3}$	Connector type[2)]: R620
		75 GHz to 95 GHz	$32 \cdot 10^{-3}$	Connector type[2)]: R900
		95 GHz to 110 GHz	$33 \cdot 10^{-3}$	Connector type[2)]: R900
Generator with mismatch correction starting from 2 GHz	1 fW to 10 pW	> DC to 100 MHz	$20 \cdot 10^{-3}$	Connector type[2)]: PC-2,92
		> 100 to 8 GHz	$21 \cdot 10^{-3}$	
		> 8 GHz to 20 GHz	$24 \cdot 10^{-3}$	
		> 20 GHz to 40 GHz	$29 \cdot 10^{-3}$	
	10 pW to 0,1 µW	> DC to 100 MHz	$15 \cdot 10^{-3}$	
		> 100 to 8 GHz	$17 \cdot 10^{-3}$	
		> 8 GHz to 20 GHz	$20 \cdot 10^{-3}$	
		> 20 GHz to 40 GHz	$26 \cdot 10^{-3}$	
	0,1 µW to 0,1 mW	> DC to 100 MHz	$10 \cdot 10^{-3}$	
		> 100 to 8 GHz	$13 \cdot 10^{-3}$	
		> 8 GHz to 20 GHz	$16 \cdot 10^{-3}$	
		> 20 GHz to 40 GHz	$23 \cdot 10^{-3}$	
	10 fW to 10 pW	> 40 GHz to 50 GHz	$43 \cdot 10^{-3}$	Connector type[2)]: PC-1,85
		> 40 GHz to 67 GHz	$49 \cdot 10^{-3}$	
	10 pW to 0,1 mW	> 40 GHz to 50 GHz	$34 \cdot 10^{-3}$	
		> 50 GHz to 67 GHz	$43 \cdot 10^{-3}$	
Generator with mismatch correction	0,1 mW to 100 mW	> DC to 1 MHz	$2{,}5 \cdot 10^{-3}$	Connector type[2)]: N50
		> 1 MHz to 100 MHz	$3 \cdot 10^{-3}$	
		> 100 to 2 GHz	$5 \cdot 10^{-3}$	
		> 2 GHz to 8 GHz	$6{,}5 \cdot 10^{-3}$	
		> 8 GHz to 12,4 GHz	$8 \cdot 10^{-3}$	
		> 12,4 to 18 GHz	$11 \cdot 10^{-3}$	
		> 18 GHz to 26,5 GHz	$11 \cdot 10^{-3}$	Connector type[2)]: PC-2,92
		> 26,5 to 40 GHz	$13 \cdot 10^{-3}$	
		> 40 GHz to 50 GHz	$21 \cdot 10^{-3}$	Connector type[2)]: PC-2.4
		> 50 GHz to 67 GHz	$33 \cdot 10^{-3}$	Connector type[2)]: PC-1.85

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Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability[1)]	Remarks
Generator without mismatch correction	100 mW to 1 W	> DC to 100 MHz	$18 \cdot 10^{-3}$	Connector type[2)]: N50
		> 100 to 2 GHz	$19 \cdot 10^{-3}$	
		> 2 GHz to 8 GHz	$30 \cdot 10^{-3}$	
		> 8 GHz to 12,4 GHz	$40 \cdot 10^{-3}$	
		> 12,4 to 18 GHz	$55 \cdot 10^{-3}$	
	1 W to 10 W	> DC to 100 MHz	$27 \cdot 10^{-3}$	Connector type[2)]: N50
		> 100 to 2 GHz	$28 \cdot 10^{-3}$	
		> 2 GHz to 8 GHz	$36 \cdot 10^{-3}$	
		> 8 GHz to 12,4 GHz	$45 \cdot 10^{-3}$	
		> 12,4 to 18 GHz	$59 \cdot 10^{-3}$	
	10 W to 30 W	> DC to 100 MHz	$58 \cdot 10^{-3}$	Connector type[2)]: N50
		> 100 to 2 GHz	$58 \cdot 10^{-3}$	
		> 2 GHz to 8 GHz	$63 \cdot 10^{-3}$	
		> 8 GHz to 12,4 GHz	$68 \cdot 10^{-3}$	
		> 12,4 to 18 GHz	$78 \cdot 10^{-3}$	
Linearity HF power ratio	1 µW to 100 µW	100 kHz to 50 MHz	0,022 dB	Connector type[2)]: N50
	100 µW to 1 mW	DC to 50 GHz	0,006 dB	Connector type[2)]: PC-2,4
		50 GHz to 67 GHz	0,008 dB	Connector type[2)]: PC-1,85
	1 mW to 100 mW	DC to 50 GHz	0,006 dB	Connector type[2)]: PC-2,4
		50 GHz to 67 GHz	0,007 dB	Connector type[2)]: PC-1,85
	1 mW to 2 W	100 kHz to 50 MHz	0,016 dB	Connector type[2)]: N50
HF voltage ratio (effective voltage)	7 mV to 70 mV	100 kHz to 50 MHz	0,020 dB	Connector type[2)]: N50
	> 70 mV to 220 mV	100 kHz to 50 MHz	0,016 dB	
	> 220 mV to 11 V	100 kHz to 50 MHz	0,013 dB	
Reflection magnitude	0,0 to 0,4	> DC to 10 GHz	0,0034	Connector type[2)]: PC-7 $\lvert\Gamma\rvert$: amplitude of reflection coefficient
	> 0,4 to 1,0	> DC to 10 GHz	$0{,}0015 + 0{,}005 \cdot \lvert\Gamma\rvert$	
	0,0 to 0,4	> 10 GHz to 18 GHz	0,0034	
	> 0,4 to 1,0	> 10 GHz to 18 GHz	$0{,}01 \cdot \lvert\Gamma\rvert$	
	0,0 to 0,4	> 18 GHz to 26,5 GHz	0,0065	Connector type[2)]: PC-3,5
	> 0,4 to 1,0	> 18 GHz to 26,5 GHz	$0{,}001 + 0{,}013 \cdot \lvert\Gamma\rvert$	
	0,0 to 0,4	> 26,5 to 40 GHz	0,011	Connector type[2)]: PC-2,92
	> 0,4 to 1,0	> 26,5 to 40 GHz	$0{,}005 + 0{,}016 \cdot \lvert\Gamma\rvert$	
	0,0 to 1,0	> DC to 2 GHz	$0{,}0035 + 0{,}0042\ \lvert\Gamma\rvert^2$	Connector type[2)]: PC-2,4
	0,0 to 1,0	> 2 GHz to 10 GHz	$0{,}0037 + 0{,}0065\ \lvert\Gamma\rvert^2$	
	0,0 to 1,0	> 10 GHz to 20 GHz	$0{,}0049 + 0{,}0090\ \lvert\Gamma\rvert^2$	
	0,0 to 1,0	> 20 GHz to 30 GHz	$0{,}0062 + 0{,}011\ \lvert\Gamma\rvert^2$	
	0,0 to 1,0	> 30 GHz to 40 GHz	$0{,}0075 + 0{,}015\ \lvert\Gamma\rvert^2$	
	0,0 to 1,0	> 40 GHz to 50 GHz	$0{,}0099 + 0{,}016\ \lvert\Gamma\rvert^2$	
	0,0 to 1,0	> DC to 2 GHz	$0{,}0035 + 0{,}0049\ \lvert\Gamma\rvert^2$	Connector type[2)]: PC-1,85
	0,0 to 1,0	> 2 GHz to 10 GHz	$0{,}0037 + 0{,}0050\ \lvert\Gamma\rvert^2$	
	0,0 to 1,0	> 10 GHz to 20 GHz	$0{,}0042 + 0{,}0069\ \lvert\Gamma\rvert^2$	
	0,0 to 1,0	> 30 GHz to 40 GHz	$0{,}0055 + 0{,}010\ \lvert\Gamma\rvert^2$	
	0,0 to 1,0	> 20 GHz to 40 GHz	$0{,}0067 + 0{,}012\ \lvert\Gamma\rvert^2$	
	0,0 to 1,0	> 40 GHz to 50 GHz	$0{,}0085 + 0{,}015\ \lvert\Gamma\rvert^2$	
	0,0 to 1,0	> 50 GHz to 67 GHz	$0{,}011 + 0{,}018\ \lvert\Gamma\rvert^2$	

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Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability[1)]	Remarks
Reflection magnitude	0,0 to 1,0	> DC to 2 GHz	$0.0036 + 0.0049 \|\Gamma\|^2$	Connector type[2)]: PC-1,00
	0,0 to 1,0	> 2 GHz to 10 GHz	$0.0036 + 0.0052 \|\Gamma\|^2$	
	0,0 to 1,0	> 10 GHz to 20 GHz	$0.0041 + 0.0068 \|\Gamma\|^2$	
	0,0 to 1,0	> 20 GHz to 40 GHz	$0.0049 + 0.0095 \|\Gamma\|^2$	
	0,0 to 1,0	> 40 GHz to 50 GHz	$0.0056 + 0.012 \|\Gamma\|^2$	
	0,0 to 1,0	> 50 GHz to 67 GHz	$0.0063 + 0.013 \|\Gamma\|^2$	
	0,0 to 1,0	> 67 GHz to 90 GHz	$0.0074 + 0.017 \|\Gamma\|^2$	
	0,0 to 1,0	> 90 GHz to 110 GHz	$0.0093 + 0.021 \|\Gamma\|^2$	
	0,0 to 1,0	> 110 to 114 GHz	$0.0122 + 0.028 \|\Gamma\|^2$	
Phase angle φ	- 180° to + 180°	> DC to 110 GHz	$U(\varphi) = \arcsin(U(\Gamma)/\Gamma) \cdot 180°/\pi$	$U(\|\Gamma\|)$: Uncertainty of reflection coefficient
Equivalent reflection factor	0,0 to 0,3	> DC to 10 GHz	0,005	Connector type[2)]: PC-7
	0,0 to 0,3	> 10 GHz to 18 GHz	0,009	
Three-port device e.g. power splitter	0,0 to 0,3	> 18 GHz to 26,5 GHz	0,011	Connector type[2)]: PC-3,5
	0,0 to 0,3	> 26,5 to 40 GHz	0,015	Connector type[2)]: PC-2,92
	0,0 to 0,3	> 40 GHz to 50 GHz	0,019	Connector type[2)]: PC-2,4
	0,0 to 0,35	> 50 GHz to 67 GHz	0,022	Connector type[2)]: PC-1,85
HF attenuation *A*	0 dB to 3 dB	> DC to 2 GHz	0,017 dB	Connector type[2)]: N50
	0 dB to 3 dB	> 2 GHz to 10 GHz	0,020 dB	
	0 dB to 3 dB	> 10 GHz to 18 GHz	0,025 dB	
	0 dB to 3 dB	> 22 GHz to 26.5 GHz	0,03 dB	Connector type[2)]: PC-3,5
	0 dB to 3 dB	> 26.5 to 40 GHz	0,04 dB	Connector type[2)]: PC-2,92
	0 dB to 3 dB	> 40 GHz to 50 GHz	0,05 dB	Connector type[2)]: PC-2,4
	0 dB to 3 dB	> 50 GHz to 67 GHz	0,06 dB	Connector type[2)]: PC-1,85
	0 dB to 3 dB	> 67 GHz to 75 GHz	0,08 dB	Connector type[2)]: PC-1,00
	0 dB to 3 dB	> 75 GHz to 110 GHz	0,10 dB	
	3 dB to 30 dB	> DC to 10 GHz	0,02 dB	Connector type[2)]: PC-7
	3 dB to 30 dB	> 10 GHz to 18 GHz	0,03 dB	
	3 dB to 30 dB	> 18 GHz to 26,5 GHz	0,05 dB	Connector type[2)]: PC-3,5
	3 dB to 30 dB	> 26,5 to 40 GHz	0,08 dB	Connector type[2)]: PC-2,4
	3 dB to 30 dB	> 40 GHz to 50 GHz	0,12 dB	
	3 dB to 30 dB	> 50 GHz to 67 GHz	0,19 dB	Connector type[2)]: PC-1,85
	30 dB to 60 dB	> DC to 10 GHz	0,04 dB	Connector type[2)]: PC-7
	30 dB to 60 dB	> 10 GHz to 18 GHz	0,05 dB	
	30 dB to 60 dB	> 18 GHz to 26,5 GHz	0,07 dB	Connector type[2)]: PC-3,5
	30 dB to 60 dB	> 26.5 to 40 GHz	0,11 dB	
	30 dB to 60 dB	> 40 GHz to 50 GHz	0,19 dB	Connector type[2)]: PC-2,4
	30 dB to 60 dB	> 50 GHz to 67 GHz	0,32 dB	Connector type[2)]: PC-1,85

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Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability[1]	Remarks
Transmission phase angle φ	-180° to 180°	> DC to 10 GHz	$U_s \cdot 180°/\pi + K \cdot f$	$U_s = \arcsin(10^{(U/20)-1})$ K:= 0,01°/GHz U: uncertainty of attenuation A in dB
		> 10 GHz to 18 GHz	$U_s \cdot 180°/\pi + K \cdot f$	
		> 18 GHz to 26,5 GHz	$U_s \cdot 180°/\pi + K \cdot f$	
		> 26,5 to 40 GHz	$U_s \cdot 180°/\pi + K \cdot f$	
		> 40 GHz to 50 GHz	$U_s \cdot 180°/\pi + K \cdot f$	
		> 50 GHz to 67 GHz	$U_s \cdot 180°/\pi + K \cdot f$	
HF noise phase noise oscillators, measuring instruments	> -77 dBc/Hz [a]	1 Hz [b]	1,5 dB	Carrier frequency: 100 MHz to 500 MHz [a] phase noise related to carrier level in dBc/Hz [b] offset frequency related to carrier frequency
	-85 dBc/Hz to -77 dBc/Hz	1 Hz	2,5 dB	
	> -92 dBc/Hz	3 Hz to 10 Hz	1,5 dB	
	-100 dBc/Hz to -92 dBc/Hz	3 Hz to 10 Hz	2,5 dB	
	> -106 dBc/Hz	10 Hz to 100 Hz	1,5 dB	
	-114 dBc/Hz to -106 dBc/Hz	10 Hz to 100 Hz	2,5 dB	
	> -136 dBc/Hz	100 Hz to 1 kHz	1,5 dB	
	-146 dBc/Hz to -136 dBc/Hz	100 Hz to 1 kHz	2,5 dB	
	> -160 dBc/Hz	1 kHz to 10 kHz	1,5 dB	
	-168 dBc/Hz to -160 dBc/Hz	1 kHz to 10 kHz	2,5 dB	
	> -167 dBc/Hz	10 kHz to 100 kHz	1,5 dB	
	-175 dBc/Hz to -167 dBc/Hz	10 kHz to 100 kHz	2,5 dB	
	> -174 dBc/Hz	100 kHz to 1 MHz	1,5 dB	
	-182 dBc/Hz to -174 dBc/Hz	100 kHz to 1 MHz	2,5 dB	
	> -186 dBc/Hz	1 MHz to 10 MHz	1,5 dB	
	-192 dBc/Hz to -186 dBc/Hz	1 MHz to 10 MHz	2,5 dB	
HF noise phase noise oscillators, measuring instruments	-64 dBc/Hz	1 Hz	1,5 dB	Carrier frequency: 500 MHz to 1 GHz
	-73 dBc/Hz to -64 dBc/Hz	1 Hz	2,5 dB	
	-82 dBc/Hz	3 Hz to 10 Hz	1,5 dB	
	-90 dBc/Hz to -82 dBc/Hz	3 Hz to 10 Hz	2,5 dB	
	-95 dBc/Hz	10 Hz to 100 Hz	1,5 dB	
	-103 dBc/Hz to -95 dBc/Hz	10 Hz to 100 Hz	2,5 dB	
	-123 dBc/Hz	100 Hz to 1 kHz	1,5 dB	
	-131 dBc/Hz to -123 dBc/Hz	100 Hz to 1 kHz	2,5 dB	
	-153 dBc/Hz	1 kHz to 10 kHz	1,5 dB	
	-161 dBc/Hz to -153 dBc/Hz	1 kHz to 10 kHz	2,5 dB	
	-170 dBc/Hz	10 kHz to 100 kHz	1,5 dB	
	-178 dBc/Hz to -170 dBc/Hz	10 kHz to 100 kHz	2,5 dB	
	-172 dBc/Hz	100 kHz to 1 MHz	1,5 dB	
	-180 dBc/Hz to -172 dBc/Hz	100 kHz to 1 MHz	2,5 dB	
	-172 dBc/Hz	1 MHz to 10 MHz	1,5 dB	
	-180 dBc/Hz to -172 dBc/Hz	1 MHz to 10 MHz	2,5 dB	

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Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability[1)]	Remarks
HF noise phase noise oscillators, measuring instruments	-55 dBc/Hz	1 Hz	1,5 dB	Carrier frequency: 1 GHz to 3 GHz
	-67 dBc/Hz to -55 dBc/Hz	1 Hz	2,5 dB	
	-67 dBc/Hz	3 Hz to 10 Hz	1,5 dB	
	-79 dBc/Hz to -67 dBc/Hz	3 Hz to 10 Hz	2,5 dB	
	-85 dBc/Hz	10 Hz to 100 Hz	1,5 dB	
	-93 dBc/Hz to -85 dBc/Hz	10 Hz to 100 Hz	2,5 dB	
	-114 dBc/Hz	100 Hz to 1 kHz	1,5 dB	
	-122 dBc/Hz to -114 dBc/Hz	100 Hz to 1 kHz	2,5 dB	
	-146 dBc/Hz	1 kHz to 10 kHz	1,5 dB	
	-155 dBc/Hz to -146 dBc/Hz	1 kHz to 10 kHz	2,5 dB	
	-166 dBc/Hz	10 kHz to 100 kHz	1,5 dB	
	-174 dBc/Hz to -166 dBc/Hz	10 kHz to 100 kHz	2,5 dB	
	-168 dBc/Hz	100 kHz to 1 MHz	1,5 dB	
	-176 dBc/Hz to -168 dBc/Hz	100 kHz to 1 MHz	2,5 dB	
	-168 dBc/Hz	1 MHz to 10 MHz	1,5 dB	
	-76 dBc/Hz to -168 dBc/Hz	1 MHz to 10 MHz	2,5 dB	
HF noise phase noise oscillators, measuring instruments	-49 dBc/Hz	1 Hz	1,5 dB	Carrier frequency: 3 GHz to 6 GHz
	-57 dBc/Hz to -49 dBc/Hz	1 Hz	2,5 dB	
	-62 dBc/Hz	3 Hz to 10 Hz	1,5 dB	
	-70 dBc/Hz to -62 dBc/Hz	3 Hz to 10 Hz	2,5 dB	
	-76 dBc/Hz	10 Hz to 100 Hz	1,5 dB	
	-84 dBc/Hz to -76 dBc/Hz	10 Hz to 100 Hz	2,5 dB	
	-105 dBc/Hz	100 Hz to 1 kHz	1,5 dB	
	-113 dBc/Hz to -105 dBc/Hz	100 Hz to 1 kHz	2,5 dB	
	-138 dBc/Hz	1 kHz to 10 kHz	1,5 dB	
	-146 dBc/Hz to -138 dBc/Hz	1 kHz to 10 kHz	2,5 dB	
	-156 dBc/Hz	10 kHz to 100 kHz	1,5 dB	
	-164 dBc/Hz to -156 dBc/Hz	10 kHz to 100 kHz	2,5 dB	
	-158 dBc/Hz	100 kHz to 1 MHz	1,5 dB	
	-166 dBc/Hz to -158 dBc/Hz	100 kHz to 1 MHz	2,5 dB	
	-158 dBc/Hz	1 MHz to 10 MHz	1,5 dB	
	-166 dBc/Hz to -158 dBc/Hz	1 MHz to 10 MHz	2,5 dB	

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Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability[1)]	Remarks
HF noise phase noise oscillators, measuring instruments	-54 dBc/Hz	1 Hz	1,5 dB	Carrier frequency: 6 GHz to 8 GHz
	-62 dBc/Hz to -54 dBc/Hz	1 Hz	2,5 dB	
	-68 dBc/Hz	3 Hz to 10 Hz	1,5 dB	
	-76 dBc/Hz to -68 dBc/Hz	3 Hz to 10 Hz	2,5 dB	
	-95 dBc/Hz	10 Hz to 100 Hz	1,5 dB	
	-103 dBc/Hz to -95 dBc/Hz	10 Hz to 100 Hz	2,5 dB	
	-122 dBc/Hz	100 Hz to 1 kHz	1,5 dB	
	-130 dBc/Hz to -122 dBc/Hz	100 Hz to 1 kHz	2,5 dB	
	-138 dBc/Hz	1 kHz to 10 kHz	1,5 dB	
	-146 dBc/Hz to -138 dBc/Hz	1 kHz to 10 kHz	2,5 dB	
	-142 dBc/Hz	10 kHz to 100 kHz	1,5 dB	
	-146 dBc/Hz to -142 dBc/Hz	10 kHz to 100 kHz	2,5 dB	
	-142 dBc/Hz	100 kHz to 1 MHz	1,5 dB	
	-150 dBc/Hz to -142 dBc/Hz	100 kHz to 1 MHz	2,5 dB	
	-142 dBc/Hz	1 MHz to 10 MHz	1,5 dB	
	-150 dBc/Hz to -142 dBc/Hz	1 MHz to 10 MHz	2,5 dB	
Linearity of indication Level ratio HF attenuation	0 dB to 21 dB	> DC to 40 GHz	0,003 dB	Attenuation *A* in dB
	11 dB to 111 dB	> DC to 40 GHz	0,003 dB + 0,0002 ·	
	111 dB to 121 dB	> DC to 40 GHz	0,03 dB	
	0 dB to 11 dB	40 GHz to 67 GHz	0,005 dB	
	11 dB to 111 dB	40 GHz to 67 GHz	0,005 dB + 0,0004 ·	
Frequency *f*	10 MHz to 100 MHz		$(2 \cdot 10^{-12} + U_{Tr}) \cdot f$	*f*: measurement value in Hz U_{Tr}: relative trigger uncertaitny
	0.10 Hz to 67 GHz		$(0{,}1 \cdot 10^{-9} + U_{Tr}) \cdot f$	
Time interval *t*	10 ns to 100 s		2 ns + $(1 \cdot 10^{-9} + U_{Tr}) \cdot t$	*t*: measurement value in s U_{Tr}: relative trigger uncertainty
Rise time *t*	7 ps to 15 ps	Voltage range changes with rise time	4 ps	*t*: measurement value in s
	> 15 ps to 25 ps		3 ps	
	> 25 ps to 100 ns		$40 \cdot 10^{-3} \cdot t$ + 2 ps	
HF voltage At 50 Ω for pulse generators according to CISPR 16-1-1	30 dB(µV) to 80 dB(µV)	9 kHz to 100 kHz	0,21 dB	bandwith: 200 Hz
		> 100 kHz to 150 kHz	0,23 dB	bandwith: 200 Hz
		> 150 kHz to 30 MHz	0,23 dB	bandwith: 9 kHz
		> 30 MHz to 1 GHz	0,26 dB	bandwith: 1 MHz

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Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability[1)]	Remarks
Amplitude modulation Modulation degree	0,0 to 1,0	$f_{MOD} \leq 100$ kHz	$0{,}002 \cdot m$	$f_{HF} > 5 \cdot f_{MOD}$ m: measurement value f_{HF} = carrier frequency f_{MOD} = modulation frequency
		100 kHz $< f_{MOD} \leq$ 500 kHz	$0{,}005 \cdot m$	
		500 kHz $< f_{MOD} \leq$ 3 MHz	$0{,}02 \cdot m$	
		3 MHz $< f_{MOD} \leq$ 6 MHz	$0{,}04 \cdot m$	
Frequency modulation Frequency depth	0 Hz to 4 MHz	0 Hz $< f_{MOD} \leq$ 100 kHz	$1 \cdot 10^{-3}$	f_{MOD} = modulation frequency
		100 kHz $< f_{MOD} \leq$ 200 kHz	$2 \cdot 10^{-3}$	
		200 kHz $< f_{MOD} \leq$ 1,5 MHz	$5 \cdot 10^{-3}$	
Phase modulation Phase depth	0 rad to (4MHz/ f_{MOD}) rad	10 Hz $< f_{MOD} \leq$100 kHz	$1 \cdot 10^{-3}$	f_{MOD} = modulation frequency
		100 kHz $< f_{MOD} \leq$ 200 kHz	$2 \cdot 10^{-3}$	
		200 kHz $< f_{MOD} \leq$ 1,5MHz	$5 \cdot 10^{-3}$	
Free space antenna factor	(depending on antenna type)	20 MHz to 1000MHz Including ground reflection, 3-antenna method	0,45 dB	
		20 MHz to < 10 GHz Without ground reflection, 3-antenna method	0,35 dB	
		10 GHz to < 18 GHz Without ground reflection, 3-antenna method	0,40 dB	

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Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability[1)]	Remarks
DC voltage	1,018 V		$2 \cdot 10^{-6} \cdot U$	U: measurement value in V
	10 V		$2 \cdot 10^{-6} \cdot U$	
DC voltage Measuring instruments	0 V to 220 mV		$10 \cdot 10^{-6} \cdot U + 1\ \mu V$	
	> 220 mV to 1000 V		$10 \cdot 10^{-6} \cdot U$	
DC voltage Voltage sources	0 V to 100 mV		$10 \cdot 10^{-6} \cdot U + 2\ \mu V$	
	> 100 mV to 100 V		$10 \cdot 10^{-6} \cdot U$	
	> 100 V to 1000 V		$20 \cdot 10^{-6} \cdot U$	
AC voltage Measurement instruments	1 mV to 220 V	10 Hz to < 20 Hz	$0{,}4 \cdot 10^{-3} \cdot U + 8\ \mu V$	$U_{max} = \frac{22 \cdot 10^6\ V \cdot Hz}{f}$ f: frequency in Hz
	1 mV to 220 V	20 Hz to 20 kHz	$0{,}21 \cdot 10^{-3} \cdot U + 2\ \mu V$	
	1 mV to 220 V	> 20 kHz to 50 kHz	$0{,}2 \cdot 10^{-3} \cdot U + 2\ \mu V$	
	1 mV to 220 V	> 50 kHz to 100 kHz	$0{,}5 \cdot 10^{-3} \cdot U + 2\ \mu V$	
	1 mV to 22 V	> 100 kHz to 300 kHz	$1 \cdot 10^{-3} \cdot U + 18\ \mu V$	
	1 mV to 22 V	> 300 kHz to 500 kHz	$1{,}8 \cdot 10^{-3} \cdot U + 20\ \mu V$	
	1 mV to 22 V	> 500 kHz to 1 MHz	$4 \cdot 10^{-3} \cdot U + 20\ \mu V$	
	> 22 V to U_{max}	> 100 kHz to 300 kHz	$1 \cdot 10^{-3} \cdot U + 16$ mV	
	> 22 V to U_{max}	> 300 kHz to 500 kHz	$5 \cdot 10^{-3} \cdot U + 30$ mV	
	> 22 V to U_{max}	> 500 kHz to 1 MHz	$8 \cdot 10^{-3} \cdot U + 80$ mV	
	> 220 V to 250 V	15 Hz to 50 Hz	$0{,}4 \cdot 10^{-3} \cdot U + 2{,}5$	
	> 220 V to 1000 V	50 Hz to 1 kHz	$0{,}11 \cdot 10^{-3} \cdot U + 2{,}5$	
	1 mV to 3,5 V	10 Hz to 30 Hz	$3{,}3 \cdot 10^{-3} \cdot U + 3\ \mu V$	U at 50 Ω
	1 mV to 3,5 V	> 30 Hz to 120 Hz	$1{,}6 \cdot 10^{-3} \cdot U + 3\ \mu V$	
	1 mV to 3,5 V	> 120 Hz to 120 kHz	$1{,}3 \cdot 10^{-3} \cdot U + 3\ \mu V$	
	1 mV to 3,5 V	> 120 kHz to 2 MHz	$1{,}5 \cdot 10^{-3} \cdot U + 3\ \mu V$	
	1 mV to 3,5 V	> 2 MHz to 10 MHz	$3{,}5 \cdot 10^{-3} \cdot U + 3\ \mu V$	
	1 mV to 3,5 V	> 10 MHz to 20 MHz	$11 \cdot 10^{-3} \cdot U + 3\ \mu V$	
	1 mV to 3,5 V	> 20 MHz to 30 MHz	$25 \cdot 10^{-3} \cdot U + 15\ \mu V$	
AC voltage Voltage sources	1 mV to 10 mV	10 Hz to 20 kHz	$0{,}5 \cdot 10^{-3} \cdot U + 4\ \mu V$	
	1 mV to 10 mV	> 20 kHz to 50 kHz	$0{,}8 \cdot 10^{-3} \cdot U + 4\ \mu V$	
	1 mV to 10 mV	> 50 kHz to 100 kHz	$5 \cdot 10^{-3} \cdot U + 4\ \mu V$	
	1 mV to 10 mV	> 100 kHz to 1 MHz	$12 \cdot 10^{-3} \cdot U + 10\ \mu V$	
	> 10 mV to 100 V	10 Hz to 20 kHz	$0{,}5 \cdot 10^{-3} \cdot U + 2\ \mu V$	
	> 10 mV to 100 V	> 20 kHz to 50 kHz	$0{,}5 \cdot 10^{-3} \cdot U + 2\ \mu V$	
	> 10 mV to 100 V	> 50 kHz to 100 kHz	$1{,}4 \cdot 10^{-3} \cdot U + 2\ \mu V$	
	> 10 mV to 10 V	> 100 kHz to 300 kHz	$4 \cdot 10^{-3} \cdot U + 2\ \mu V$	
	> 10 mV to 10 V	> 300 kHz to 1 MHz	$11 \cdot 10^{-3} \cdot U + 10\ \mu V$	
	> 100 V to 700 V	10 Hz to 20 kHz	$0{,}8 \cdot 10^{-3} \cdot U + 2$ mV	
	> 100 V to 700 V	> 20 kHz to 50 kHz	$1{,}4 \cdot 10^{-3} \cdot U + 2$ mV	
	> 100 V to 700 V	> 50 kHz to 100 kHz	$3{,}2 \cdot 10^{-3} \cdot U + 2$ mV	
DC current Current sources	0 µA to 10 µA		10 nA	I: measurement value in A
	> 10 µA to 100 µA		$0{,}10 \cdot 10^{-3} \cdot I + 6$ nA	
	> 100 µA to 0,22 A		$0{,}10 \cdot 10^{-3} \cdot I$	
	> 0,22 A to 2,2 A		$0{,}14 \cdot 10^{-3} \cdot I$	

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Measured quantity / Calibration item	Range	Measurement conditions / procedure	Best measurement capability[1)]	Remarks
AC current Current sources	0 A to 1 µA > 1 µA to 100 A > 100 µA to 100 mA > 100 mA to 1 A > 1 A to 60 A		10 nA $0{,}10 \cdot 10^{-3} \cdot I + 1$ nA $0{,}1 \cdot 10^{-3} \cdot I$ $0{,}2 \cdot 10^{-3} \cdot I$ $0{,}2 \cdot 10^{-3} \cdot I$	
AC current Measuring instruments	100 µA to 220 µA > 220 µA to 2,2 mA > 2,2 mA to 22 mA > 22 mA to 220 mA	10 Hz to 20 Hz	$0{,}3 \cdot 10^{-3} \cdot I + 16$ nA $0{,}3 \cdot 10^{-3} \cdot I + 40$ nA $0{,}3 \cdot 10^{-3} \cdot I + 400$ nA $0{,}3 \cdot 10^{-3} \cdot I + 4$ µA	
	100 µA to 220 µA > 220 µA to 2,2 mA > 2,2 mA to 22 mA > 22 mA to 220 mA > 220 mA to 2,2 A	> 20 Hz to 1 kHz	$0{,}2 \cdot 10^{-3} \cdot I + 10$ nA $0{,}2 \cdot 10^{-3} \cdot I + 35$ nA $0{,}2 \cdot 10^{-3} \cdot I + 350$ nA $0{,}2 \cdot 10^{-3} \cdot I + 3{,}5$ µA $0{,}2 \cdot 10^{-3} \cdot I + 35$ µA	
	100 µA to 220 µA > 220 µA to 2,2 mA > 2,2 mA to 22 mA > 22 mA to 220 mA > 220 mA to 2,2 A	> 1 kHz to 5 kHz	$0{,}3 \cdot 10^{-3} \cdot I + 12$ nA $0{,}22 \cdot 10^{-3} \cdot I + 110$ $0{,}22 \cdot 10^{-3} \cdot I + 550$ $0{,}22 \cdot 10^{-3} \cdot I + 3{,}5$ $0{,}47 \cdot 10^{-3} \cdot I + 80$ µA	
	100 µA to 220 µA > 220 µA to 2,2 mA > 2,2 mA to 22 mA > 22 mA to 220 mA > 220 mA to 2,2 A	> 5 kHz to 10 kHz	$1{,}1 \cdot 10^{-3} \cdot I + 0{,}1$ µA $1{,}2 \cdot 10^{-3} \cdot I + 1$ µA $1{,}2 \cdot 10^{-3} \cdot I + 5$ µA $1{,}2 \cdot 10^{-3} \cdot I + 10$ µA $7{,}1 \cdot 10^{-3} \cdot I + 160$ µA	
AC current Current sources	100 µA to 1,2 mA 100 µA to 1,2 mA 100 µA to 1,2 mA	10 Hz to 20 Hz > 20 Hz to 45 Hz > 45 Hz to 10 kHz	$6{,}0 \cdot 10^{-3} \cdot I + 0{,}1$ µA $3{,}5 \cdot 10^{-3} \cdot I + 0{,}1$ µA $2{,}6 \cdot 10^{-3} \cdot I + 0{,}1$ µA	
	> 1,2 mA to 120 mA > 1,2 mA to 120 mA > 1,2 mA to 120 mA	10 Hz to 20 Hz > 20 Hz to 45 Hz > 45 Hz to 10 kHz	$6 \cdot 10^{-3} \cdot I + 1$ µA $3{,}2 \cdot 10^{-3} \cdot I + 1$ µA $2{,}3 \cdot 10^{-3} \cdot I + 1$ µA	
	> 120 mA to 1 A > 120 mA to 1 A > 120 mA to 1 A > 120 mA to 1 A	10 Hz to 20 Hz > 20 Hz to 45 Hz > 45 Hz to 5 kHz > 5 kHz to 10 kHz	$6 \cdot 10^{-3} \cdot I + 1$ µA $3{,}3 \cdot 10^{-3} \cdot I + 1$ µA $2{,}7 \cdot 10^{-3} \cdot I + 1$ µA $4{,}7 \cdot 10^{-3} \cdot I + 1$ µA	
DC resistance resistors, measuring instruments	0 Ω to 10 Ω > 10 Ω to 100 Ω > 100 Ω to 100 kΩ > 100 kΩ to 1 MΩ > 1 MΩ to 10 MΩ > 10 MΩ to 100 MΩ > 100 MΩ to 1 GΩ		$15 \cdot 10^{-6} \cdot R + 60$ µΩ $12 \cdot 10^{-6} \cdot R + 0{,}5$ mΩ $15 \cdot 10^{-6} \cdot R$ $15 \cdot 10^{-6} \cdot R + 2$ Ω $5 \cdot 10^{-6} \cdot R + 0{,}1$ kΩ $0{,}6 \cdot 10^{-3} \cdot R$ 5,1 · 10-3 · R	*R*: measurement value in Ω

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